

UNITED PLANTERS' ASSOCIATION OF
SOUTHERN INDIA

SCIENTIFIC DEPARTMENT

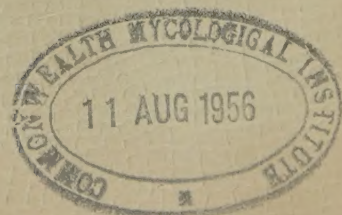
(TEA SECTION)

ANNUAL

ADMINISTRATION REPORT

FOR

1955-1956



NOTE :

Specimens for laboratory examination should be sent by *unregistered* parcel post to

The Officer-in-Charge,
UPASI Tea Experiment Station,
Devarshola P. O.,
Nilgiris.

In the case of specimens too bulky to send by post, they should be sent by rail to Ootacamund and the Rail Receipts or Parcel Way Bills sent to

The Rajalakshmi Motor-Service,
Ootacamund.

for collection and forwarding to Devarshola.

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LIST OF CONTENTS

	PAGE
Report of the Chief Scientific Officer	1
Meteorological Data	7
Report of the Asst. Scientific Officer and Entomologist ...	8
Report of the Soil Chemist	12
Report of the Botanist	15

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Scientific Department

Technical Staff

MR. P. DE JONG, B.A., (Hons.) Oxon	<i>Chief Scientific Officer</i>
MR. S. ANANDA RAU, M.Sc.	<i>Asst. Scientific Officer & Entomologist</i>
MR. V. JAYARAMAN, B.A., B.Sc. (Ag.)	<i>Chemist</i>
DR. K.S. VENKATARAMANI, M.Sc. Ph.D., F.B.S.	<i>Botanist</i>

Junior Staff

MR. E. P. POWELL	<i>Field Recorder</i>
MR. K. I. ABRAHAM	<i>Clerk—Devarshola</i>
MR. D. ARUNACHALAM	<i>Clerk—Coonoor</i>

Laboratory Attenders

MR. SANKARAN NAIR
MR. MADHAVAN CHETTY

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United Planters' Association of Southern India

Annual Report of the UPASI Scientific Department

TEA SECTION

For 1st April 1955—31st March 1956.

REPORT OF THE CHIEF SCIENTIFIC OFFICER

PART I—ADMINISTRATION.

There were no changes in the technical staff of the Scientific Department during the year under review.

UPASI Tea Experiment Station, Devarshola: The new water supply scheme, mentioned in the previous report was completed during the present year and has proved to function satisfactorily throughout the dry weather. With the exception of normal maintenance of laboratory and store buildings, staff and labour accommodation no additions or alterations were made to the UPASI Experiment Station.

Climatic conditions during the year were in general favourable, 71" of rain being recorded on 161 days. As in previous years, however, the period December to March has been extremely dry and this recurrent failure of the North-East monsoon rains is proving to be progressively more damaging to the tea in the district.

From the 13 acres of tea in bearing, 67,369 lbs. of green leaf were harvested and sold to our landlords, Woodbriar Estates Ltd., at a figure of 6 annas a pound, realising a sum of Rs. 25,263/6/-. Based on an average out-turn of 23%, this amount of green leaf represents an average yield of 1,192 lbs. of made tea per acre. This increase in crop for the year is to a certain extent accounted for by the new policy of adopting a 4-year pruning cycle and altering the normal pruning period to April/May. Because of this alteration no tea at the Experiment Station was pruned during the year under review. The monthly distribution of crop for the year was as follows:

	Lbs./green leaf.	Average for past 5 years.
April 1955	3,396	3,478
May	8,001	6,745
June	5,367	6,293
July	6,812	7,497
August	8,141	6,453
September	6,965	6,356
October	10,216	8,073
November	6,707	4,264
December	4,063	2,827
January 1956	3,351	2,257
February	1,846	2,033
March	2,504	2,379
	67,369	58,655

Publications : A number of articles on various subjects appeared in the bi-monthly issues of the *Planters' Chronicle*, written by various members of the technical staff. In addition, Scientific Advisory Leaflet No. 6, "Mites of Tea in Southern India" and Advisory Leaflet No. 7, "Flush worm", both prepared by the Entomologist, were also issued.

Since the previous Annual Report little progress has been made with the publication of Bulletin No. 14, "The Common Root Diseases of Tea in Southern India". The manuscript for this publication was completed over 12 months ago and has now reached the final proof stage, but considerable difficulty has been experienced in producing colour blocks of a suitable standard for inclusion in the book and its publication has accordingly been delayed. A new approach to this problem has now been made and it is hoped that satisfactory coloured illustrations will be forthcoming within the next few months and the Bulletin issued during the year 1956-57.

Touring : During the year under review the Chief Scientific Officer visited the Nelliampathys in April 1955, Mundakayam, Central Travancore P. A. and the High Wavys in September 1955, Singampatti, Mundakayam, Central Travancore P. A. and the High Range in January 1956 and the Central Food Technological Research Institute, Mysore, with the Chairman of the Tea Board in August 1955. In February 1956 he attended the Annual Scientific Conference of the Indian Tea Association Scientific Department at Tocklai. In addition visits were made to Calcutta to attend regular meetings of the *Ad hoc* Research Committee of the Tea Board in June, July, October and December 1955 and March 1956.

During the visit to Central Travancore in September, two talks on "The Future of the UPASI Scientific Department" and "Flush worm" were given to members of the District Planters' Association by the Chief Scientific Officer. On the occasion of the visit to the C. F. T. R. I., Mysore in August, he addressed a Seminar on the subject of "The Adulteration of Tea".

UPASI Exhibition : The practice of holding a short general scientific conference in connection with the Annual General Meetings of the UPASI during August has been discontinued, as it is considered that the Annual Scientific Conference, now a regular feature, provides adequately for this purpose. During the UPASI Exhibition the Scientific Department had on display a number of examples of the common insect pests of tea.

Fourth Annual Conference of the Scientific Department : This Conference was held at "Glenview" on the 28th March 1956 and was attended by delegates representing the various District Planters' Associations and many visitors from the planting community and commercial houses associated with planting. Also present at the meeting were Mr. J. V. Harbord from the Tea Research Institute of Ceylon, Dr. V. N. Patwardhan, Director, Nutrition Research Laboratories, Coonoor, Shri C. P. Natarajan of the Central Food Technological Research Institute, Mysore, and Shri C. P. Bhimayya, Soil Conservation Officer, Government of India Training Centre, Ootacamund.

The proceedings of the Conference have been published as Bulletin No. 15 of the UPASI Scientific Department and have already been distributed to all member estates.

Boards and Committees : The Chief Scientific Officer continued to represent the Association on the Board of the Indian Council of Agricultural Research, Crops

and Soils Wing, the Nilgiri District Soil Conservation Board and the Fertiliser Sub-Committee of the Indian Standards Institute. He also acted as alternate representative for Shri D. C. Kothari on the Madras State Soil Conservation Board.

Tea Board *Ad hoc* Research Committee: As mentioned during the previous Annual Report, the Chief Scientific Officer was coopted as a member of the Tea Board *Ad hoc* Research Committee and attended 5 meetings in Calcutta during the year. Of major importance to the South Indian industry was the subject of expansion of the UPASI Scientific Department which was considered in great detail by the *Ad hoc* Research Committee. As a result of negotiations between the Association and the Tea Board a plan has been formulated whereby the UPASI Scientific Department will be developed on the lines of a Central Laboratory and field station, whose precise location has not yet been decided, and a Sub-station in Central Travancore. Capital for these projected developments will be made available by the Tea Board and the annual recurring expenditure will be met by the UPASI. For this purpose a maximum contribution of Rs. 1/4/- per subscribing acre has been set by the Association.

Visitors: During the year we welcomed a number of representatives of commercial organisations both in Coonoor and at Devarshola. The Experiment Station was visited by the Chairman and Members, Plantation Inquiry Commission in April 1955, and on other occasions by the President, UPASI, the Chairman of the Planting Committee, the Chairman of the Tea Board and Officers of the Central Food Technological Research Institute, and the Coffee Board Research Department. Mr. D. L. Downie, Senior Tea Research Officer, Department of Agriculture, Nyasaland, visited Coonoor in February 1956.

PART II—RESEARCH AND ADVISORY.

As in former years, most of the attention of the Scientific Department has been devoted to advisory problems and in providing memoranda for estates on a variety of matters. In the course of this work a large number of laboratory examinations of soils, fertilisers and fertiliser mixtures were carried out and, as will be seen from the report of the Soil Chemist, 1750 estimations were made, many of them extremely laborious. It is too often not realised that many of the analyses called for by member-estates are of little practical value and of no use in determining fertiliser, etc. policies.

Turning to the work of the various sections, throughout the year interest has been focused on three major problems, namely, certain aspects of the manuring of tea, general problems of entomology and the laboratory evaluation of fungicides for Blister Blight control.

Manuring of Tea : Mention has been made in previous Annual Reports of the continuance of observations on certain plots of the 27-Plot Experiment, discontinued in 1953/54, which are designed to give us additional information on the effects of cessation of manuring and the long term effects of with-holding phosphatic fertilisers.

In the case of cessation of fertiliser applications we now have information about the performance of tea, previously manured at an average rate of 80:30:30 NPK per acre, which has had no fertiliser since the last routine application made in April 1953.

In Table I, which follows, the yields for the 4 individual plots are shown for the 2nd and 3rd years of the pruning cycles II, III, and IV. These years correspond to the 2nd and 3rd years of the present pruning cycle, which is in the post-manuring period. In presenting this information the yields recorded during the 2nd and 3rd years of the 1st pruning cycle have been omitted, as at this stage of the experiment the fertiliser applications were not showing their full effects.

TABLE I

Cessation of Manuring — Lbs. green leaf per plot.

Second and third years of Pruning Cycle.

	Plot 8	Plot 17	Plot 18	Plot 27	Mean	
Cycle II	778/631	591/432	721/530	858/699	737/573	
Cycle III	697/684	446/475	635/628	765/756	636/636	
Cycle IV	1050/768	696/522	887/632	1288/850	980/693	
Mean of 3 cycles	842/694	578/476	748/597	970/768	784/634	709
Post-manuring	798/730	467/388	632/510	820/763	679/598	639
% reduction					13.4%/5.7%	9.9%

Reference to Table I shows that the mean yield of green leaf for the 4 plots was 784 lbs. for the second years of the three pruning cycles during which fertilisers were being applied, but in the period 1953/54, the first corresponding year of observation in the post manuring period, the mean yields dropped to 679 lbs., a decrease of 105 lbs. of green leaf per plot or a reduction of 13.4%. In the case of the 3rd year, the mean plot yield for the three cycles when fertilisers were applied was 634 lbs. green leaf and in the post-manuring period 598 lbs., a decrease of 36 lbs. of green leaf or a reduction of 5.7%. The average for the 2nd and 3rd years of the pruning cycles shows a reduction of 70 lbs. or an average reduction of about 10% in the case of the post-manuring period. These reductions in yield are still not as marked as those obtained in North-East India where the initial decline has been recorded as being in the order of 45%, in the case of tea being manured at the rate of 80 lbs. of nitrogen per acre. (Gokhale, N. G., *Emp. Jour. Expt. Agr.* Vol. XXIII, No. 90, April 1955). On high-yielding tea however a decrease of the order of 10% over two years can mean a considerable reduction in terms of made tea per acre and it is likely that the loss of crop, under present day conditions at any rate, would offset any saving made as a result of ceasing to apply fertilisers. The policy of reducing or omitting fertiliser applications as a measure of economy would seem to require careful consideration in the light of these figures.

With regard to the omission of phosphates from fertiliser mixtures a certain amount of information is now available regarding the behaviour of tea which has been receiving nitrogen and potash at an average rate of 60 lbs. and 40 lbs. per acre respectively for 17 years. The information is presented in Table II.

TABLE II

Effect of with-holding Phosphates.

Yield per plot in lbs. green leaf.

	<i>Plot 5</i>	<i>Plot 9</i>	<i>Plot 15</i>	<i>Plot 26</i>	<i>Mean</i>
Average for 3 pruning cycles.	450	508	500	434	473
1954/55	406	706	614	548	568
% increase or reduction	— 9.8	+ 39	+ 23	+ 26.3	+ 20.1

It will be seen from the above figures that, except in the case of plot No. 5, where during the period 1954/55 there has been a reduction in yield of 9.8%, all the other plots show an increase in yield and the average for the four plots shows an increase of 20.1% in green leaf per plot during the last year. The indications are, therefore, that by withholding phosphates since 1939 no detrimental effects have yet appeared in the tea.

In this section of my previous report a passing mention was made of an investigation into the effects of fertiliser applications to tea in the form of foliar sprays. These investigations have been continued and are commented on in the report of the Botanist. They were also discussed by Dr. Venkataramani at the Fourth Annual Conference of the Scientific Department and details are given in Bulletin No. 15. These investigations which were originally started to determine the possibility of rehabilitating inferior areas of tea are being continued and extended to compare soil methods of fertiliser application with foliar application in the form of sprays on healthy as well as debilitated tea.

A question which has frequently been put to the Scientific Department during this year is "How much nitrogen can I safely apply to my high-yielding tea?" and there are now instances in South India where applications of nitrogen at the rate of 180 lbs. N. per acre and even more, are being applied to certain areas of tea. No critical information is available on this extremely important point, but early in 1955 an experiment was laid down by the Manager of Nonsuch Estate with some assistance from the Scientific Department in design and layout. This experiment, which is in two parts, covers a total of 58.8 acres and has been laid out in two blocks with each of the four treatments replicated twice, a total of 16 blocks. The treatments are the normal NPK application which is 96: 42: 54/NPK per acre and the normal application increased by 25%, 50% and 75%. The fertilisers have been applied in two equal applications, in February/March and July/August. Yield figures are available up to the 29th February 1956, twelve months from the commencement of the experiment and show no statistical significance, but there is an overall increase of approximately 200 lbs made tea per acre between the lowest and the highest applications of fertiliser. This trial will be continued for several years and with the co-operation of the Management of Nonsuch Estate we hope to obtain information of considerable interest and practical value. Our thanks are due to the Manager for his interest and for making the yield records available for statistical analysis.

Entomological Problems: The year 1955/56 was marked by the appearance in epidemic form of Flush worm, *Cydia (Laspeyresia) leucostoma* in certain areas of

Central Travancore. This pest has always been noticed on tea in South India, but this year in Central Travancore and to a certain extent in some other districts, infestations reached alarming proportions and the Entomologist visited the area on two occasions to carry out local investigations. Flush worm has been the subject of an advisory leaflet and also formed the topic of discussion in the entomological section of the Fourth Annual Scientific Conference, where control measures and recommendations have been set out. It is proposed to continue field investigations into the status of this pest during the next year with a hope that, should a recurrence of the pest occur, effective and economic control measures may be devised.

Screening of Fungicides and Insecticides : During the year work continued on the laboratory evaluation of copper fungicides for Blister Blight control and although these investigations have not been attended with the practical success that we originally hoped, they have produced information of considerable value and have provided a basis for the comparison of fungicides within the laboratory. This aspect of the work of the Scientific Department was discussed in detail at the Fourth Annual Conference and full report will be found in the pages of Bulletin No. 15.

Chemical Standards for Tea : During the early part of 1955 a considerable amount of interest was displayed by the Tea Board and the tea industry in the problems of Waste Tea Rules and tea adulteration. This interest was heightened as a result of the publication in September 1955 of the Government of India Prevention of Food Adulteration Rules which included certain definitions and chemical standards for Black Tea. The question of standards of tea was discussed by the Tea Board *Ad hoc* Research Committee and it was eventually decided to entrust an investigation into the chemical standards of Black tea and the prevention of adulteration to the Division of Food Processing, Central Food Technological Research Institute, Mysore. A meeting was arranged between the Director, C. F. T. R. I., and the Chairman of the Tea Board in August 1955 at which I was present and as a result a scheme of investigation was formulated. This Department has cooperated in the scheme by arranging for the regular supply of standard samples of Black tea to the Division of Food Processing, C. F. T. R. I., and we are also maintaining records of the analyses and arranging for payment of samples. Certain aspects of this investigation have been described in a paper "Tea, Its Definition and Chemical Standards" delivered at the Fourth Annual Scientific Conference which is reproduced in Bulletin No. 15 and has also appeared in the 1st April 1956 edition of the *Planters' Chronicle*.

Acknowledgments : Once again it is my pleasant duty to acknowledge with gratitude the assistance we have received from all sections of the planting industry in South India and in particular the Secretariat of UPASI and the Planting Committee. Commercial organisations have continued to be generous in providing formulations for our investigations, machinery for trial and fertilisers for certain manuring experiments—so generous that it was in fact at times impossible to cope with the flood of samples.

Cordial relations continue to exist between this Department and our colleagues at the Tea Research Institutes of Ceylon and East Africa and the Indian Tea Association Scientific Department at Tocklai and as noted earlier it was a pleasure to receive Mr. Downie, Senior Tea Research Officer, Nyasaland and to establish personal relationships with his research organisation. I should like to acknowledge the cooperation of Agents and Managers of estates concerned in the conduct of field experiments and those who have offered hospitality to myself and all members of the Scientific Department during the year.

PETER DE JONG,
Chief Scientific Officer.

* at 1 foot depth

REPORT OF THE ASSISTANT SCIENTIFIC OFFICER AND ENTOMOLOGIST 1955 — 1956

Administration :

The Assistant Scientific Officer was in charge of the Devarshola Experiment Station throughout the year. Periodic visits were made to the Station by the Chief Scientific Officer in whose report will be found the details of the working of the Station.

Correspondence :

Correspondence dealt with at the Station numbered 930 letters received and 985 despatched. These figures are very much the same as those of last year. They included 262 technical enquiries as against 297 reported last year. Although they are numerically less than those of the previous year, the volume of work entailed in dealing with them was greater, as is evidenced by the number of chemical analyses carried out during the year.

Touring :

The following tours were made during the year :—

April 1955	... Nelliampathies with Chief Scientific Officer.
July/August 1955	... Rousdon Mullay, Devon and Rockwood Estates, Nilgiri-Wynaad. Coonoor — UPASI Meetings and Exhibition. Terramia, Parkside and Nonsuch Estates, Nilgiris.
Sept./October 1955	... Devarashola and Mayfield Estates, Nilgiri-Wynaad.
Sept /October 1955	... Central Food Technological Research Institute, Mysore, with the Soil Chemist. Mundakayam and Central Travancore P. A.'s Estates with the Chief Scientific Officer.
November 1955	... Kalajothi, Devon and Rockwood Estates, Nilgiri-Wynaad.
January 1956	... Central Travancore P. A.'s Estates.
February/March 1956	... Rousdonmullay, Woodbriar and Kalajothi Estates, Nilgiri-Wynaad. Coonoor — Fourth Annual Scientific Conference.

Periodic visits were made to Mayfield Estate in connection with trials with acaricides carried out there.

Publications :

An article on "Flush-worm" was published as Advisory Leaflet No. 7, which appeared in the *Planters' Chronicle* dated 15th January 1956.

"Johnson's Note Book for Tea Planters", third enlarged edition, was reviewed in the *Planters' Chronicle* dated 15th January 1956.

"Flush-worm" again formed the subject of a paper contributed to the Fourth Annual Scientific Conference held in March 1956, the proceedings of which appear in Bulletin No. 15 of the Scientific Department.

ENTOMOLOGICAL.

Advisory :

Entomological enquiries were numerous during the year, their number being the largest on any one subject among the total number of enquiries received at the Station. The year was exceptional in that damage by insect and mite pests was experienced on a bigger scale than in any previous year. Flush-worm which is usually a minor pest of tea assumed serious proportions and was the cause of considerable damage on some estates in Central Travancore. Red Spider and Purple Mite were on the increase and necessitated the adoption of control measures over larger areas than previously. Scarlet Mite, the damage by which was hitherto considered negligible in South India, was reported from a few estates where its attack had resulted in considerable damage to large areas of tea. An epidemic of Tea Aphis broke out in Central Travancore in the early months of 1956.

Helopeltis :

There was no enquiry concerning this pest and the apprehension previously expressed in some quarters that *Helopeltis* may have acquired resistance to DDT was not raised again. It is probable that this is largely due to greater attention given to the proper application of chemicals for control. Two visits paid during the year to Central Travancore generally indicated that the pest was well under control.

Red Spider and other Mites :

Mites formed the subject of a large number of enquiries received during the year and there appeared to be a greater appreciation than in the past of the need for measures to control them. Red Spider (*Paratetranychus bioculatus*, W-M.) and Purple Mite (*Calacarus carinatus*, Green) continued to be the two predominant species, but a few cases of serious damage by Scarlet Mite (*Brevipalpus australis*, Tucker) also came to notice during the year. Judging by the nature of its damage, this mite can be more destructive than either Red Spider or Purple Mite.

It was believed that Yellow Mite (*Hemitarsonemus latus*, Banks) which is a troublesome pest in Ceylon, does not occur on tea in South India, but an instance of damage by what appears to be this species was noted during the year on an estate in the Nilgiris. Its distribution, however, is yet very restricted and the damage on the whole is negligible.

The work of screening acaricides for efficiency as well as taint was continued. YF 3798 and YF 3799 (experimental Ovotran formulations supplied by Plant Protection Ltd.), Akar 338 (Geigy Insecticides Ltd.), Karathane (Amritlal & Co., Ltd.), CP/36/55 (Fisons Pest Control Ltd.) and Sandoz product 2030/20 (Elatin)

were all found to impart no taint to made tea at spray concentrations recommended by the manufacturers. Teas made from leaf sprayed with Duphar Tedion V-18 (N. V. Phillips - Roxane) at 1 lb. in 100 gallons were judged to be tainted and the tasters' opinion was inconclusive in respect of samples sprayed with Aramite (Bombay Chemicals Ltd.) at 1 lb. in 50 gallons. Tests with the last acaricide will have to be repeated, especially as a Tocklai report mentions that this product does not taint tea.

Acaricidal trials were carried out on a large field scale with Spersul and Akar 338 against Scarlet Mite and a preliminary trial on a small scale with two experimental acaricides, Sandoz 2030/20 (Ekatin) and CP/36/55. Spersul gave the best control and although satisfactory control was achieved with Akar 338, the latter did not eliminate the mites to the same extent that Spersul did. The efficiencies of Sandoz 2030/20 and CP/36/55 have not been satisfactorily assessed yet, though the indications are that they are probably of the same order as that of Akar 338.

Phytotoxicity tests were carried out with Akar 338 on two different occasions (wet and dry weather periods) as a result of which it was concluded that there is no danger of any damage to even the tender buds by the use of this product at the concentrations at which it is usually recommended to be employed for spraying against mites.

The question of incorporating an acaricide in the copper sprays towards the end of the Blister Blight season has been raised from time to time. While there are a number of acaricides which are compatible with copper sprays, the different application rates required for the control of Blister Blight and mites render a combined spray programme difficult to adopt in practice. Nevertheless, the value of a combined spray is worthy of further investigation.

Flush-worm :

The severity of attack by Flush-worm reached alarming proportions on a few estates in Central Travancore, as a result of which the Chief Scientific Officer and the Entomologist visited the district to investigate the position on the spot. Immediately after the visit a note on the pest was prepared and circulated for the information of members of the district. Subsequently, in view of the pest having appeared in more than usual abundance in other districts also, a leaflet on the pest was published in which all the information available on the subject was presented.

In January 1956, a field trial laid out on a statistical basis was carried out on an estate in Peermade in order to assess the efficiency of Malathion, DDT and Endrin in the control of the pest. The time however, was not ideal for the conduct of the trial as the pest was on the decline. Nevertheless, the results indicated that control with DDT and Malathion was fairly satisfactory whereas that with Endrin was disappointing. Full details of this trial are to be found in Bulletin No. 15. The liability of Malathion to taint the tea is still under examination and definite conclusions are expected to be reached shortly.

It is hoped that the next Flush-worm season will provide an opportunity to reassess the value of the different insecticides and also to further study the pest in all its aspects, particularly the aspect of biological control.

Apart from a definite loss of crop as a result of Flush-worm attack, there is strong reason to believe that the damage by the pest may adversely affect the quality of the made tea, but critical evidence in support of this view is yet lacking.

Tea Aphis :

A sudden outbreak of the common Tea Aphis, (*Toxoptera aurantii*, Boyer), in almost epidemic form was observed on estates in Central Travancore in January 1956. The outbreak, however, was shortlived and the insects disappeared as quickly as they appeared and before much damage was done. The reasons for this sudden appearance are not clearly understood, though the unusual climatic conditions and the possible destruction of the natural enemies of this insect as the result of the large scale use of insecticides appear to be the most likely contributory causes.

Minor Pests :

The minor or occasional pests which were reported during the year and are worthy of record here are the following :— Red Coffee Borer (*Zeuzera coffeae*, Nietn.), Red Slug (*Heterusia virescens*, Butl.), Tea Tortrix (*Homona coffearia*, Nietn.), Tea Leaf Miner (*Melanagromyza* sp.), Faggot-worm (*Clania crameri*, Westw.), Tea Leaf Roller (*Gracilaria theivora*, Wlsm.), *Terias blanda*, Boisd. (Yellow butterfly), Cockchafer grub (in nursery), *Ceroplastes* sp. (scale), *Pseudococcus* sp. (mealybug) on tea, *Mylocerus viridanus*, F. (weevil) and *Sthenias grisator*, Fb. (ringer) on Dadap, *Terias blanda*, Boisd. on Gliricidia, *Phassus* sp. (borer) on Red Gum and a Termite (unidentified) on Grevillea.

ACKNOWLEDGMENTS

The co-operation and assistance received from Managers of estates in the conduct of field experiments are gratefully acknowledged.

Acknowledgments are also due to the Manager-in-India, Travancore Tea Estates Co., Ltd., for providing housing facilities to the Assistant Scientific Officer during his stay in Central Travancore and to the General Manager, Southern India Tea Estates Co., Ltd., for help received in connection with the conduct of a field trial on Ladrum Estate.

It is also a pleasure to record appreciation of the hospitality received from Managers of estates visited during the year.

S. ANANDA RAU,

Asst. Scientific Officer & Entomologist.

REPORT OF THE SOIL CHEMIST

(1955 — 1956)

Advisory & Research :

The following samples were analysed in connection with advisory and research work :

Soil	...	181
Manures & Manure Mixtures	...	48
Composts	...	7
Drier ash	...	1
China clay	...	1
Tea samples	...	49
Fungicides	...	36
Insecticides	...	15

(involving 1,750 estimations)

Most of the soil samples were tested for their reaction and organic matter content in order to assess their suitability for use in tea nurseries. Full analyses — physical and chemical — were carried out on a few samples which were used for vegetative propagation of tea. Soil samples from the Station Experimental area were analysed to determine the effect of continuous use of sulphate of ammonia on pH value and CaO content.

The manures and manure mixture samples were up to the guaranteed analyses.

The tea samples were analysed for (i) crude fibre content in order to find whether potash had any effect on crude fibre, (ii) copper content after spraying with copper fungicide, both with and without a sticker, and (iii) detecting adulteration.

All the fungicides were tested for total copper, suspension power and rain-fastness.

The insecticides examined were BHC and DDT formulations, both proprietary and locally mixed.

In addition to the above analyses a number of enquiries on manuring and cultivation were dealt with.

Blister Blight Trials:

I cooperated with the Botanist in the conduct of a field trial with various copper fungicides.

Publications :

“Work of the Chemistry Section” formed the subject of a paper contributed to the Scientific Conference in March 1956.

Short accounts were given in this paper of,

- i) the laboratory evaluation of wettable copper fungicides,
- ii) the effect of continuous use of sulphate of ammonia on the calcium status and reaction of soil,
- iii) the effect of potash on crude fibre in tea,
- and iv) the effect of manuring on earliness of tipping.

"A Note on the Adulteration of Tea" was published in the *Planters' Chronicle* dated January 15, 1956, jointly with the Chief Scientific Officer.

FIELD EXPERIMENTS :

A. 27 PLOT (3 x 3 x 3) FACTORIAL EXPERIMENT

Tea Experiment Station : Yield records are being maintained in respect of eight plots, four to study the effect of continued withholding of phosphoric acid and the other four to study the effect of cessation of manuring.

B. 15 PLOT (3 x 5 RANDOMISED BLOCK) EXPERIMENT.

Tea Experiment Station : The yield figures for the period May 1955—April 1956 are given below.

Yield in lbs. green leaf.

	Nitrogen 60 lbs /acre	Potash 60 lbs./acre	Nitrogen + Potash 60 lbs. + 30 lbs./acre
Pre-treatment yields — 9 months	727	752	747
May 1955/April 1956	1,165	988	1,250

The differences between treatments are not significant. The trial is being continued and the covariance analysis between (i) plant population and (ii) preliminary yield and final yield will be commented on later.

C. 25 PLOT (5 x 5 RANDOMISED BLOCK) EXPERIMENT.

High Range (Kanniamallay, Munnar, Letchmi and Nullatanni Estate):
The yield figures for these four trials are given in the following table.

	Yield in lbs. made tea per acre				
	No Manure	N	NP	NK	NPK
Kanniamallay (Pruned January 1955, yield for 5 months).	415.8	451.4	448.7	433.6	430.4
Munnar (yield from April 1955 to March 1956).	874.3	948.2	894.8	998.5	973.1

Letchmi (yield for 8 months, April 1955 to March 1956).	365.6	375.3	334.8	391.5	737.1
Nullatanni (yield for 6 months — April 1955 to October 1955).	322.4	510.3	581.7	529.2	710.1

The yield differences are not significant on Kanniamallay and Munnar Estates. On Nullatanni, the differences between 'No Manure' and 'NPK', and 'No Manure' and 'NP' are significant at the 5% level, the critical difference being 228.2 lbs. On Letchmi, treatment 'NPK' has yielded significantly more crop than the other treatments, the critical difference being 195.2 lbs

D. 25 PLOT (5 x 5 RANDOMISED BLOCK) EXPERIMENT.

Nilgiri-Wynaad: Rockwood: The area was rested for the greater part of the period April 1955 — August 1955 and pruned during August 1955. The experiment will be continued for another cycle.

E. SOIL AMENDMENT TRIALS.

The tea on Mayfield Estate was pruned during the last week of August 1955. Yield figures for the three trials are as follows:

	Yield in lbs. made tea per acre.					
	No Manure	Ammonium Sulphate	Amendment	NPK	NPK + Amendment	Sig. Diff 5%
Mayfield (May 1955-August 1955).	276.3	—	286.1	497.3	472.8	78.1
Daverashola (May 1955-April 1956).	765.6	1050.0	710.6	1151.6	1222.1	175.5
Craigmore (March 1955-February 1956).	537.0	—	567.0	772.0	772.0	53.0

The pattern of yield response is the same as during the previous years. The differences between 'No Manure' and 'Amendment' are very small and not significant. While 'NPK' has given significantly higher yields than 'No Manure', the addition of 'Amendment' to 'NPK' has not resulted in any advantage. On Daverashola, the 'Ammonium Sulphate' treatment has given significant increase in yield over 'No Manure' and the difference between 'Ammonium Sulphate' and 'NPK + Amendment' just reaches significance this year.

Acknowledgments:

Thanks are due to the Managers of Estates visited during the year for the assistance willingly given in the conduct of field experiments.

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Soil Chemist.

REPORT OF THE BOTANIST

(1955 — 1956)

Advisory :

Technical enquiries relating to tea constituted, as usual, the major portion of the advisory work. Several queries of botanical and pathological interest on shade and fuel trees and green manures, and a few on coffee and rubber were also received and dealt with during the year.

Touring :

Three estates in the Nilgiri-Wynaad and two in the Nilgiris were visited in connection with research programmes and for advisory purposes. The details of the visits made to estates are as follows :

April 1955	— Kalajothi Estate, Nilgiri-Wynaad (Advisory),
„	— Mayfield Estate, Nilgiri-Wynaad (Experiment on foliar application of fertilisers),
May 1955	— Mayfield Estate, Nilgiri-Wynaad (Experiment on foliar application of fertilisers),
August 1955	— Nonsuch Estate, the Nilgiris (Advisory),
„	— Parkside Estate, the Nilgiris (Advisory),
„	— Coonoor (UPASI Annual General Meetings),
September 1955	— Rockwood Estate, Nilgiri-Wynaad (Advisory),
November 1955	— Mayfield Estate, Nilgiri-Wynaad (Experiment on foliar application of fertilisers),
December 1955	— Mayfield Estate, Nilgiri-Wynaad (Experiment on foliar application of fertilisers),
March 1956	— Coonoor (Scientific Conference).

Publications :

A note entitled “Physiologic specialisation in *Exobasidium vexans*” was prepared for publication.

A paper on “Pathology, Physiology and Propagation”, summarising the work of the botanical section during the year 1955-1956, was contributed to the Fourth Annual Scientific Conference.

TEA.**1. GENERAL :**

There was no serious outbreak of any disease. Root diseases continued to be reported from all the districts and it is emphasized once again that *elimination of infectious material from the soil is the only reliable method of controlling the root infecting fungi*. A stem disease, ‘branch canker’, caused by the fungus *Macrophoma theicola* was reported from a few estates on the Nilgiris.

2. BLISTER BLIGHT EXPERIMENTS :

Biological Evaluation of Copper Fungicides : Several formulations based on cuprous oxide, copper oxychloride and colloidal copper were tested in the laboratory. The ED 50 and ED 95 and the tenacity values of these formulations were determined.

Field Trial : Twenty-seven formulations (comprising four organic fungicides, one mercurised copper oxychloride, one copper naphthanate, two colloidal coppers, nine cuprous oxides and ten copper oxychlorides) were tested in the field. The organic fungicides were not as effective as the copper fungicides in the control of Blister Blight. The copper fungicides were all almost equally effective.

The details of these investigations are presented in Bulletin No. 15, 'Proceedings of the Fourth Annual Conference, 1956' in the paper, "Laboratory Evaluation of Copper Fungicides" by Peter de Jong.

Physiologic Specialisation in *Exobasidium vexans* : A tea bush which has been highly resistant to Blister Blight for about seven years, was found to be infected with the disease in September 1955 and mature sporing blisters were found on some of the tender shoots. Microscopic examination of the fungal growth on this bush as well as that on other bushes revealed no morphological difference between them. Pathogenicity tests indicated that the fungus infecting the hitherto 'resistant' bush belongs to a distinct physiologic race of *E. vexans*. The results of the pathogenicity tests are presented in the following tables.

A. Inoculation of 'resistant' bush with spores obtained from blisters seen on the same bush.

<i>Method of inoculation.</i>	<i>No. of inoculations.</i>	<i>No. of positive infections.</i>
Spore suspension	24	22
Discs of sporing blisters	24	17

B. Inoculation of a 'susceptible' bush with spores obtained from blisters seen on the 'resistant' bush.

<i>Method of inoculation.</i>	<i>No. of inoculations.</i>	<i>No. of positive infections.</i>
Spore suspension	24	20
Discs of sporing blisters	24	15

C. Inoculation of 'resistant' bush with spores from 'susceptible' bush.

<i>Method of inoculation.</i>	<i>No. of inoculations.</i>	<i>No. of positive infections.</i>
Spore suspension	24	Nil
Discs of sporing blisters	24	Nil

D. Inoculation of a 'susceptible' bush with spores from the 'susceptible' bush.

<i>Method of inoculation.</i>	<i>No. of inoculations.</i>	<i>No. of positive infections.</i>
Spore suspension	24	23
Disks of sporang blisters	24	14

Artificial inoculation of the tender leaf tissues of the 'resistant' bush with spores secured from blisters on its own leaves resulted in the development of blisters, but infection of the leaf did not take place when spores obtained from a susceptible bush were employed. On the other hand, tender leaves of an ordinarily susceptible bush could be successfully infected with spores from both sources. These results indicate the existence of different physiologic races of the fungus. The knowledge of the existence of physiologic races is of great importance in breeding or multiplication by selection and vegetative propagation of resistant clones. A further critical study of physiological specialisation in this fungus is, therefore, called for. It is proposed to continue this study during the next Blister Blight season.

Resistance to Blister Blight: In the Annual Report for the year 1949-1950, a brief account of the mechanism of resistance to Blister Blight was given and it was then suggested that resistance was due to hypersensitivity. Further work carried out during the present year confirmed the previous finding. Artificial inoculation of the tender leaves of a resistant bush failed, except that small spots, which never developed into mature blisters, were formed at the site of inoculation. The spore germinated on the leaf surface and penetrated the epidermal cell but the progress of the invading hypha was checked by resistance offered by the death of the host cell. In the susceptible leaf, the mycelium was seen to spread through the intercellular spaces of the mesophyll. On the other hand in the resistant tissue, the host cells surrounding the infection locus of the fungus became necrotic, i. e. the cells surrounding the invading hypha were discoloured and dead.

A preliminary comparative study of the chemical constitution of the resistant and susceptible leaf tissues was started. Tests for amino acids, employing paper chromatography, indicated that resistant and susceptible leaves contained the same range of amino acids, but that the glutamic acid content was always higher in the case of the susceptible leaf than in the resistant one. These tests were purely qualitative and further work on the amino acid content as well as on the other constituents is planned for the coming year.

3. FOLIAR APPLICATION OF FERTILISERS:

This experiment, which was started on Mayfield Estate in October 1954 (Ref. Ann. Report for 1954-55, pp. 16-17), was continued for the second year. The first spray application of fertilisers for the second year was given in December 1955 and the second application will be given in April 1956.

Full details of this trial are given in the Annual Report for the year 1954-55 (pp. 16-17) and in the Proceedings of the Fourth Annual Conference of the Scientific Department, Bull. No. 15, 1956. The yield and growth measurement data obtained till the end of the year are summarised below:

Yield Data

<i>Lbs. green leaf from 6 plots (plot size : $\frac{1}{12}$ acre)</i>				
<i>Period.</i>	<i>Control.</i>	<i>Potash sprayed.</i>	<i>NPK Mixture sprayed.</i>	<i>Conclusion.</i>
(a) January/March 1955 (6 plucking rounds)	282	324	350	Differences highly significant { C. D. @ 5% level—38 @ 1% level—54
(b) April/June 1955 (8 plucking rounds)	573	625	619	Not significant
(c) July/September 1955 (8 plucking rounds)	576	719	702	Differences significant C. D. @ 5% level—116
(d) October/December 1955 (6 plucking rounds)	541	624	615	Not significant
(e) The whole year 1955 (28 plucking rounds)	1972	2292	2286	Differences significant C. D. @ 5% level—284
(f) January/March 1956 (7 plucking rounds)	267	357	404	Differences highly significant. { C. D. @ 5% level—45 @ 1% level—63

The bushes have shown a good response to foliar application of both potash (52 lb. K_2O /acre) and NPK mixture (50 lb. N, 15 lb. P_2O_5 and 52 lb. K_2O /acre). The first set of spraying was done in December 1954 — January 1955 and at this time the control plots were sprayed with water. As the differences in yields obtained from the control plots and the fertiliser sprayed plots were highly significant, it was considered that the marked increase in yields obtained during the dry period January — March 1955 was due to the fertilisers and not the water contained in the spray. It was, therefore, decided to discontinue the spray application of water to the control plots during the subsequent fertiliser applications.

Although the total yield obtained from the fertiliser sprayed plots during the year 1955 was greater than that from the control plots, the response to spraying was the highest in the dry period, January to March 1955. A similar trend was also observed in the second year of the trial, the yield from the potash and NPK mixture sprayed plots being significantly higher than that from the control plots. During January—March 1956, the NPK sprayed plots also yielded more than the potash sprayed plots, a feature which was not noticed in the previous year

Growth Measurements: The effect of the foliar spray was also shown in the growth of the young branches, for example in the increase in girth. The percentage increase in girth (expressed as increase in diameter) over the initial girths of 20 random branches in each treatment ten months after the commencement of the experiment is given below:

<i>Branch No.</i>	<i>Percentage increase in diameter over the initial values.</i>		
	<i>Control.</i>	<i>Potash sprayed.</i>	<i>NPK sprayed.</i>
1	4.2	16.5	20.7
2	6.7	20.5	21.7
3	11.6	18.7	21.2
4	7.4	15.3	21.2
5	14.3	20.0	20.5
6	7.9	21.4	21.9
7	15.0	19.2	21.8
8	6.9	12.8	13.6
9	8.0	22.5	20.4
10	11.8	16.3	20.9
11	12.5	22.7	14.1
12	14.3	22.6	18.4
13	10.2	13.7	22.2
14	13.0	7.9	22.0
15	13.8	20.0	24.4
16	16.3	14.3	16.3
17	17.5	21.8	22.4
18	18.6	12.2	21.8
19	11.7	18.3	16.4
20	10.5	7.8	10.8
Average	11.6	17.2	19.6

4. VEGETATIVE PROPAGATION:

Some preliminary laboratory trials were made to determine the effect of three different rooting media on the development of callus tissue at the lower cut-end of internodal cuttings. The following were the tentative findings: the local clay-loam soil and this medium with the addition of sand to give a total sand content of 60 per cent. were conducive to callus formation and root development. The roots formed in these media were thin and fibrous. Pure sand encouraged rapid and excessive development of the callus tissue and very few roots were formed in this medium. The roots produced in pure sand were thick and brittle.

In one of the trials, it was found that excessive amounts of moisture in the rooting medium, the rooting medium being fully saturated, also encouraged heavy callus growth at the expense of the development of the roots.

The technique of growing cuttings enclosed within 'alkathene' tubing (described in Bull. No. 15, Proceedings of the Fourth Annual Conference, 1956) was employed in these trials. Further work on these lines is contemplated for the following year.

GREEN MANURE, COVER CROP AND SHADE PLANTS.

Crotalaria greenwayii, *C. incana* and *C. recta* introduced from East Africa did not make satisfactory growth. Thornless mimosa (*Mimosa invisa inermis*) from Indonesia made excellent growth and set seed profusely. This species, however, appears to be a good cattle fodder and as such it may not be quite suitable as a cover crop in unprotected fields.

Indigofera teysmanii also did not make a satisfactory growth at the Experiment Station. It was, however, found to grow luxuriantly at the Ambalavayal Farm in the Wynaad Colonisation Scheme from where the seed was obtained. A species of *Phyllosticta* was seen infecting the stems and leaves of the young plants and this fungal infection resulted in the wilting and death of the plants.

Priotropis cytisoides, introduced from N. E. India, was not very promising. It was found to be heavily infested with an insect pest (*Ragmus importunitas*?) in November-December. Owing to the insect attack, the growth of the plants was stunted and the shoots were malformed.

A species of *Cercospora* infecting seedlings of *Peltophorum ferrugineum* was noticed on two occasions. This fungal attack resulted in the total loss of seedlings in the nursery. The pathogenicity of this micro-organism was proved by artificial inoculations and it was also found that it could attack and kill the seedlings at the cotyledonary stage itself.

Root diseases of *Acacia decurrens*, *Cassia* sp., *Glyricidia sepium* and *Millettia oblata* were reported from some estates. Species of *Fusarium* were the only fungi which were consistently found in association with the diseased roots. In the case of *Acacia decurrens*, *Cassia* sp. and *Millettia oblata*, discoloration of the wood of the root, simulating the typical symptom of vascular diseases caused by *Fusaria* was evident. The fungus infecting mature *Cassia* trees was identified as *Fusarium oxysporum* infec.

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